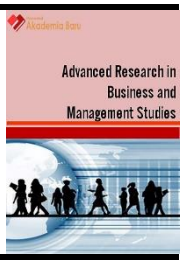
Penerbit Akademia Baru

Journal of Advanced Research in Business and Management Studies

Journal homepage: www.akademiabaru.com/submit/index.php/arbms
ISSN: 2462-1935



Unveiling the Impact of Transformational Leadership on Safety Performance Measures in Malaysia's SME Sector: A Two-Stage PLS-SEM Analysis

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ARTICLE INFO

Article history:
Received 19 April 2023
Received in revised form 20 June 2023
Accepted 24 July 2023
Available online 21 August 2023

Keywords:
Transformational leadership; safety performance; SME; safety compliance; safety participation

ABSTRACT

This paper presents a comprehensive exploration of the relationship between transformational leadership, safety behavior, and organizational safety performance within Malaysia's Small and Medium Enterprises (SMEs) sector, offering a fresh perspective grounded in social exchange theory and domino theory. It leverages a two-stage higher-order structural model to analyze responses from a sample of 107 Safety & Health Officers and Human Resource Officers from various SMEs in the Northern Region of Malaysia. Our findings affirm a significant direct link between safety behavior and organizational safety performance, additionally underscoring the mediatory role of safety behavior variables in the positive association between transformational leadership and safety performance. The outcomes of this research not only extend our empirical understanding of the role of transformational leadership in workplace safety within SMEs but also provide actionable insights for industry practitioners. As such, this study makes a robust contribution to academic and industry discourse, proposing a validated higher-order model for enhancing safety performance in Malaysia's burgeoning SME sector.

1. Introduction

The escalating frequency of workplace accidents worldwide, with an alarming rise in Malaysia, calls for urgent measures [1-3]. Malaysian Small and Medium Enterprises (SMEs) role is significant in national employment [4-5]. However, SMEs account for 60%-70% of industrial accidents annually [6-8]. Safety behavior was determined as the attribute to these accidents worldwide including Malaysia. The determinants towards safety behavior are mainly insufficient safety management, and a lack of effective safety leadership [9-18].

Given SMEs' financial and resource constraints [17,19,20] current safety improvement strategies prove unfeasible, necessitating an alternative approach [21-22]. This study, hence, proposes a cost-effective solution: inculcating self-regulation practices among supervisors through safety leadership, drawing on internal resources for sustainable and affordable occupational safety and health (OSH) management [23-24]. Previous research supports this approach, substantiating

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safety leadership's capacity to influence safety behavior and predict safety outcomes [8,17]. Additionally, safety leadership is posited as the most efficacious strategy in addressing this issue [25].

Present study conceptualizes safety leadership as a process of interaction between leaders and followers, focused on achieving organizational safety goals [23]. Notably, transformational leadership, a leadership style that enhances followers' intrinsic motivation and personal development to meet organizational objectives, is deemed pivotal [26-27]. Previous literature utilized safety motivation and safety concern as representative dimensions of transformational leadership and determined their significant effects towards safety behavior component namely safety compliance and safety participation.

Meanwhile, safety coaching and caring served as proxies for transformational leadership [28], whereby revealed to have significant effect on safety performance [29-31]. Following these underpinnings, our study establishes a research framework where transformational leadership influences safety performance, mediated by safety behavior. This framework acknowledges the crucial role of leadership in shaping safety behavior, which in turn influences overall safety performance. Hence, the proposed framework allows for an in-depth analysis of the safety leadership's impact on safety behavior and, consequently, on safety performance in the SME context.

2. Methodology

The theoretical construct for this study integrates three primary theories: social learning theory, social exchange theory, and the domino theory. Social learning theory asserts that individuals acquire knowledge not only through direct experience but also by observing and emulating others' behaviors [32]. This complex interplay of cognitive, behavioral, and environmental factors plays a vital role in shaping behavior, including safety practices in an organizational setting [33].

Social exchange theory highlights the importance of relationships, wherein the perceived benefits surpass the costs, thereby fostering mutual trust and positive interactions. This theory serves as a foundation for understanding workplace behaviors, stressing the significance of reciprocal relationships between employers and employees as pivotal determinants of voluntary safety behavior [34,35].

Heinrich's domino theory (1941) suggests accidents are a consequence of a chain reaction, initiated by personal faults leading to unsafe actions or conditions, and eventually resulting in accidents and injuries. Removing any link in this chain – especially unsafe actions or conditions – can prevent the entire sequence, thereby enhancing safety performance [36]. Collectively, these theories provide a comprehensive framework to investigate how social learning and interaction, combined with proactive risk management, can positively influence an organization's safety performance.

Together with those underpinning theories, present research adapts framework, characterizing leadership as a distal situational factor, with safety performance (compliance and participation) as a mediating variable and safety outcomes (i.e. accidents, injuries) as the dependent variable [37]. These constructs were reshaped, measuring safety behavior through safety compliance and participation [38-39], and redefining safety outcomes as safety performance, measured by frequencies of accidents, injuries and property damages [29,40].

The term "safety performance" is subject to debate, with varying interpretations across studies. Some researchers focus on individual safety behaviors [41-43], while others emphasize safety outcomes as safety performance [29,31,40]. By examining both aspects, this study aims to clarify

the definition of safety performance and uncover the relationship between safety behavior and outcomes. Similarly, Christian *et al*., [37] underscored the necessity of integrating both safety behavior and outcomes within the same framework, positing differential influences on antecedent variables. Accordingly, safety behavior is chosen as the mediator, being a proximal variable related to psychological factors. Building upon these premises, the conceptual research framework has been meticulously formulated, as illustrated in Figure 1.

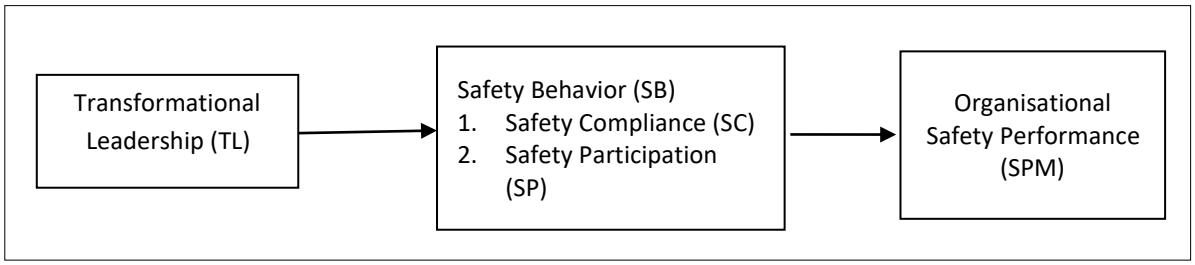

Fig. 1. Research Framework

Furthermore, the study engaged 107 representatives from small and medium manufacturing firms in Penang, Perlis, and Kedah, Malaysia comprising roles related to human resources management, focusing on occupational safety and health. The G*Power 3.1.9.7 software was utilised to determine the minimum required sample size. Three primary variables— transformational leadership, safety behavior, and safety performance— were adapted from previous studies and modified to suit the study context. Instruments were translated into Malay for clarity and underwent a pre-test for validity and reliability checks. All items were measured using a 5-point Likert scale ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

The data analysis was carried out using Partial Least Squares Structural Equation Modeling (PLS-SEM), a powerful tool for analyzing complex interrelationships between observed and latent variables. The constructs in our model are of two types: lower-order and higher-order. Lower-order constructs are directly measured by indicators or observed variables, while higher-order constructs are formed by a combination of multiple lower-order constructs. The lower-order constructs in this study represent dimensions of the higher-order construct. The use of higher-order constructs enables us to represent complex concepts that are multidimensional in nature.

Given the complex nature of our model with higher-order constructs, we will use the two-stage approach [44] for model specification and estimation. This method involves using all the indicators of the lower-order constructs as indicators of the higher-order construct in the measurement model. The results of the PLS-SEM analysis will provide insight into the interplay between transformational leadership, safety behavior, and safety performance. Employing a second-order construct in the analysis allows the researcher to effectively capture the complexity and multidimensional nature of certain constructs that cannot be directly measured by a single set of indicators.

3. Results

This study conducted a measurement model assessment for the lower-order framework. Furthermore, the study conducted a structural model assessment to examine the higher-order framework together with hypotheses testing.

3.1 Assessment of Measurement Model (Lower-Order)

This section discusses the results obtained from the surface pressure measurement study. The effects of angle of attack, Reynolds number and leading-edge bluntness are discussed in the next sub section.

3.1.1 Construct validity

In examining the measurement model prior to the structural model, a reflective measurement approach was adopted. Assessment of the reflective model is divided into two sections namely construct validity and discriminant validity. It encompassed four primary steps: measurement of indicator loadings, assessment of internal consistency reliability, verification of convergent validity, and assurance of discriminant validity.

Based on the results depicted in Table 1, all indicator loadings surpassed the acceptable threshold of 0.708, denoting substantial reliability and explaining over half of the indicator's variance [45]. Composite reliability (CR) provided an evaluation of internal consistency reliability, offering a more accurate measure than Cronbach's Alpha [45]. With CR values ranging between 0.70 and 0.95, the internal consistency was deemed satisfactory to good [46]. Convergent validity was confirmed by average variance extracted (AVE) values exceeding the recommended 0.5, illustrating that over 50% of item variance was accounted for [47-48].

Table 1
The results of Construct Validity

Model Constructs	Measurement Items	Loadings	AVE	CR
Transformational Leadership (TL)	TL1	0.839	0.697	0.948
	TL2	0.846		
	TL3	0.815		
	TL4	0.833		
	TL5	0.876		
	TL6	0.851		
	TL7	0.843		
	TL8	0.771		
Safety Participation (SP)	SP1	0.882	0.827	0.935
	SP2	0.937		
	SP3	0.909		
Safety Compliance (SC)	SC1	0.909	0.867	0.951
	SC2	0.944		
	SC3	0.940		
Organisational Safety Performance (SPM)	SPM1	0.917	0.832	0.952
	SPM2	0.891		
	SPM3	0.903		
	SPM4	0.937		

3.1.2 Discriminant validity

Discriminant validity was ensured, signifying that the construct items were more distinct from each other than from other constructs. Cross-loadings, Fornell-Larcker criterion or Heterotrait-Monotrait (HTMT) ratio are always used for assessing discriminant validity [46]. However, Hair *et al*., [47] stressed that HTMT is preferable to be used compared to the criteria given by Fornell-

Larcker. For conceptually the same construct, HTMT values should be lower than 0.9 [46,49]. Table 2 depicted the results of HTMT values.

Table 2
The results of Discriminant Validity

	SP	SC	SPM	TL
SC				
SP	0.753			
SPM	0.654	0.581		
TL	0.605	0.756	0.547	

3.2 Assessment of Structural Model (Higher-Order)

To reduce complexity in model structure, higher-order constructs are deployed [48]. This study conceptualizes safety compliance and safety participation as second-order constructs with formative indicators, conforming to a reflective-formative type II model [50]. Employing Sarstedt *et al*., [44] two-stage approach allows the first-order constructs for safety behavior (safety compliance and safety participation) to be modeled to the higher-order constructs. The strength of the structural model is evaluated via the coefficient of determination (R^2 values) of the endogenous construct [49,51]. Depending on the R^2 values, the magnitude of endogenous constructs that can be explained by the independent variables can be quantified [46,52,53]. The results depicted in Table 3 revealed that 49 % variance of safety behavior is explained by transformational leadership, whereas, 38% variance of safety performance is explained by safety behavior.

In addition, Cohen's effect size (f^2) assists in assessing the influence of predictor constructs. Effect size allows for meaningful comparisons across different studies and is useful in situations where we need to know the strength of the relationship between variables, rather than just whether a relationship exists or not [54]. Depending on the f^2 values, the impact can be large, medium, or small [52]. Results as depicted in Table 4 demonstrates that transformational leadership exerts a significant influence on safety behavior, which, in turn, plays a considerable role in shaping the safety performance of organizations.

Table 3
The results of R^2

	R^2
SB	0.49
SPM	0.38

Table 4
The results of effect size, f^2

	SB	SPM	TL
SB		0.610	
SPM			
TL	0.961		

Employing the two-stage approach for testing hypotheses, a bootstrapping analysis with 5,000 resamples established significant direct effects of transformational leadership on safety behavior ($\beta = 0.70$, $p<0.05$), and safety behavior on safety performance ($\beta = 0.62$, $p<0.05$). Also, safety behavior emerged as a significant mediator in the relationship between transformational leadership and

safety performance (β=0.43, p<0.05). Tables 5 and 6 offer a summary of these results. In addition, Figure 2 depicted the structural model for this research.

Table 5
Path-coefficient (higher-order) direct effect

	β	T Statistics	P Values
SB -> SPM	0.616	6.614	0.000
TL -> SB	0.700	13.055	0.000

Table 6
Path-coefficient (higher-order) indirect effect

	β	T Statistics	P Values
TL -> SB-> SPM	0.431	5.875	0.000

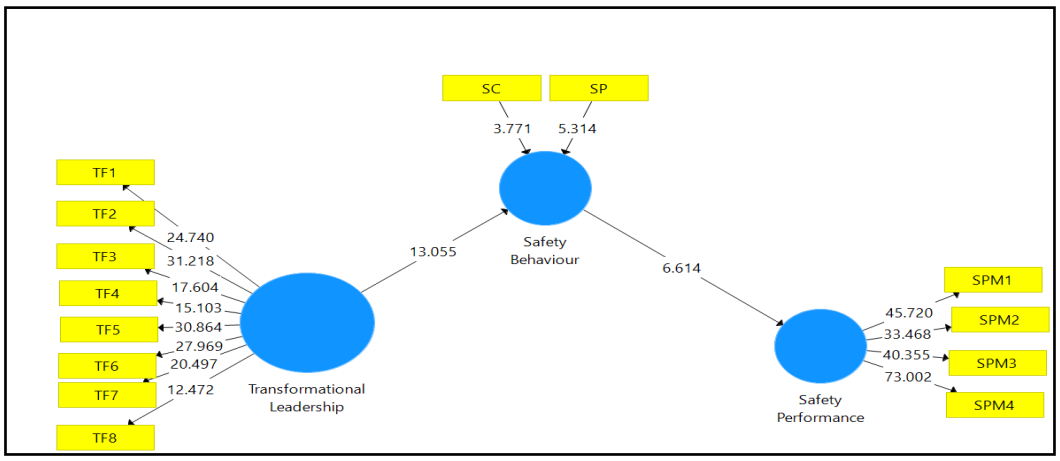

Fig. 2. Second-order structural model

In a nutshell, the mediation effect of safety behavior in the relationship between transformational leadership and safety performance broadens the understanding of the interaction between these constructs. It suggests that transformational leadership impacts safety performance not just directly but also indirectly through its influence on safety behavior, validating the perspective that leadership shapes safety outcomes via its effect on individual and collective behaviors [55]. Overall, these results contribute to the growing literature on safety in organizational contexts, providing empirical evidence for the relationships between transformational leadership, safety behavior, and safety performance. However, given the contextual dynamics of workplaces, it's advised that future research further explore these relationships in varied organizational settings.

4. Conclusions

This research elucidates the instrumental influence of transformational leadership in instigating safety behavior, thereby augmenting safety performance within organizational structures. Notably, the mediating function of safety behavior in bridging the relationship between transformational leadership and safety performance delineates the intricate dynamic between leadership modalities, behavioral norms, and safety outcomes.

The rigorous analytical approach undertaken within this research has yielded potent findings that substantially contribute to the expanding corpus of literature concerned with safety within the

organizational context. These findings emphasize the imperative of embracing transformational leadership techniques and fostering an environment conducive to safety-oriented behaviors in order to enhance overall safety performance. Consequently, these findings provide an invaluable strategic roadmap for organizational leaders seeking to elevate their safety standards.

Despite the depth of these insights, the research's contextual boundaries must be acknowledged. It is recommended that future studies extend the exploration of these relational dynamics within varied organizational contexts, to ensure broader applicability and bolster generalizability of the findings. As such, the potent influence of transformational leadership on safety outcomes continues to present an exciting avenue for future scholarly examination.

Acknowledgement
The authors express sincere gratitude to all those who contributed to this research, whose invaluable insights and assistance significantly elevated the quality and impact of this study.

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